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Research Article

Burn-related Injuries among Arbaeen Participants in Karbala City, 2024

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Abstract

Background: Burns are a global public health problem. They occur during the mass gatherings, resulting in injuries with some unique challenges. The annual Arbaeen is the world's second-largest public gathering, celebrated in Iraq, attracting more than 20 million pilgrims. This study aims to evaluate the role of the Arbaeen pilgrimage on burned patients.

Methods: A cross-sectional study was conducted at Imam AI-Hussain Medical City Hospital in 2024. The records of burned patients who were admitted to the Emergency Department during Arbaeen were included. Data was also collected for another group of burned patients, which parallels the timeframe of Arbaeen, to compare the two groups.

Results: Sixty-seven burn injuries were included in the Arbaeen study group, and ninety-seven patients in the out-of-Arbaeen group. The Arbaeen pilgrimage records fewer burn injuries than usual times, with an incidence of 0.31% against 0.75% ($p = 0.019$). The majority of Arbaeen participants (43.3%) were between the ages of 18 and 38 years. Among out Arbaeen participants, those less than 18 years old comprise the larger group. This study revealed that 52.2% of Arbaeen patients received conservative treatment and were discharged from the Emergency Department, while 17.9% were admitted to a burn unit. The mortality rate was 7.5% during Arbaeen and 4.1% out of Arbaeen, respectively.

Conclusions: Children and young people are most vulnerable to burns during the Arbaeen pilgrimage period. The incidence of burn injuries is not significantly correlated with the Arbaeen pilgrimage.

Keywords: burn; Arbaeen; pilgrimage; emergency; mass gathering

Introduction

Burns may result from skin exposure to various heat sources, including fires, heated objects, oils, scalding liquids, chemicals, and electricity [1]. Burn injuries demonstrate considerable variety based on their severity. The patient's comorbidities may influence the clinical outcome of the burn. Morbidity and mortality typically escalate with an increase in the burn's surface area [2]. Burns are a prevalent reason for hospitalization and are the fourth top cause of injury, following road traffic incidents, falls, and interpersonal conflicts. Additionally, burns constitute a significant leading cause of mortality in developing countries [3-4]. According to the World Health Organization, fire burns are responsible for more than 300,000 deaths annually. Furthermore, burns impact around one million individuals each year globally [5]. While it is estimated that a small percentage of burn injuries result in fatalities, this form of trauma is among the most severe, leading not only to mortality but also to significant disability, disfigurement, psychological issues, and social impacts on the burned patients and their families, particularly in low- and middle-income countries [6-7].

Healthcare providers must be familiar with the management of burns, even if their emergency room is not connected to a registered burn center [8]. The extent of burn depth and the damaged body surface will ascertain the necessity for admission and fluid resuscitation; not all burns necessitate surgical intervention, as most may be managed with local wound care [9].

According to the American Burn Association, burns were classified into three degrees [10]. A superficial (first-degree) burn affects only the epidermis. These burns can cause considerable pain and heal without scarring within 5 to 10 days. Partial-thickness burns (second-degree) impact the

superficial layer of the dermis. These burns are characterized by severe pain, and recovery often transpires within 2 to 3 weeks with negligible scarring. A deep partial-thickness burn involves the deeper reticular dermis. These burns may heal without surgical intervention; however, the process is prolonged, and scarring is inevitable. Full-thickness burns (third-degree burns) are the most severe, involving both the epidermis and dermis layers of the skin. They also penetrate the subcutaneous tissue. The nerves at this depth are further impaired, leading to loss of sensation or pain. These burns necessitate over 8 weeks for healing and require surgical intervention. This new classification system has replaced the older first, second, and third-degree classification system.

Recently, wealthy nations have significantly reduced burn-related mortality and morbidity involving self-inflicted burns through enhanced public awareness, prevention strategies, and improvements in secondary and tertiary healthcare, along with support programs [11]. The predominant incidence of burn injuries arises in low- to middle-income countries that are characterized by underdeveloped health systems and inadequate infrastructures, which are insufficient in preventing or mitigating the severity of burns. This is also partly related to overpopulation, substandard housing, and hazardous cooking methods [12-13]. Furthermore, among burn victims, 25.9% had a history of mental health issues, and 14.8% were related to suicide attempts [14].

Most burn complications can be avoided; managing these complications frequently correlates with an improvement in quality of life for the affected individuals in the future. Treatment for the particular patient should start with enough first aid to minimize tissue damage, morbidity, and surgical requirements [15]. Burn epidemiology differs throughout countries and even within a given country over time [11]. According to the Iraq Injury Surveillance System, burns are the second most prevalent cause of emergency department admissions in Iraq. However, there is a limitation of local studies that explore burn epidemiology [16-17].

The Arbaeen pilgrimage has become recognized as one of the largest and most expansive mass gatherings in the world. The Arbaeen ceremony in Islamic history has been a massive, potent, and impressive phenomenon with tremendous cultural, political, and civilization-building significance. It is a global trend that is gaining momentum on an annual basis. In a transnational, enormous march, millions of individuals gather in Iraq and walk to Karbala [18]. Karbala lies 100 kilometers southwest of Baghdad, the capital of Iraq [19]. The annual Arbaeen celebration in Iraq attracts more than 20 million pilgrims, which makes it the world's largest annual gathering in one spot [20]. Every year, pilgrims from more than 60 countries worldwide arrive in Iraq to visit Karbala to carry out the Arbaeen pilgrimage [21]. During the Arbaeen pilgrimage, millions of visitors go through hundreds of kilometers on foot through all the roads leading to Karbala province to reach the city center, where the shrine of Imam Hussain (peace be upon him) and his brother Abbas is situated. The highest number of pilgrims in Karbala is observed between the first and 22nd days of Safar, the second month of the Hijri calendar [21-22].

Visitors pass by numerous ‘Mawakibs’ (transient camps and a few built units) established by local Iraqis and some international charities, providing resting and sleeping places for walkers, and food booths providing hot tea, juices, and almost all types of main dishes, and snacks [22].

Burn injuries that occurred during the mass gatherings resulted in injuries with some unique challenges [23]. Burn management of injured individuals necessitates specialized skills, professional knowledge, and prompt access to particular resources. The lack of instantaneous (on-scene) patient care and the repercussions of inadequate early decision-making in patient management can significantly impact patient outcomes and the ability of healthcare facilities to provide suitable burn care [24]. Mass gathering incidents that involve several burn-injured individuals have shown the extensive demands placed on healthcare workers and local health facilities, as well as the high morbidity and mortality rates that occur. Due to the rise in burn incidence during gatherings globally and the significant disparities in countries' capacity to manage burn care, it is urgent to intensify burn management efforts and understand its fundamental principles [25].

This study aims to evaluate the role of the Arbaeen pilgrimage on patients with burns at Imam AI-Hussein Medical City Hospital in 2024.

Materials and Methods

Patients

A cross-sectional study is designed for this study. This study was conducted at Imam Al-Hussein Medical City Hospital. It is the biggest general

teaching hospital in Karbala Province. The burn unit of the hospital had 18 functional beds (10 for pediatrics and eight for adults) and was under the supervision of the Plastic and Reconstructive Surgery Department. There were 26 nurses specially trained in burn care, two plastic surgeons, and one general practitioner. There was one dedicated operating room.

Patients who were admitted between August 10th and 30th in 2024 and matched the 5th to the 25th of Safar 1446 were included in this cross-sectional study. Furthermore, patients admitted between June 10th and 30th, 2024, were included for comparison. The study utilized the evaluation of patient files and forensic reports of burned patients who were referred to the emergency department (ED).

Exclusion criteria: Six patients from the Arbaeen group and eight from out Arbaeen group with inadequate or incomplete files were excluded from the study. Patients burned with inhalation injuries were also excluded (one from the Arbaeen group and two from out Arbaeen group).

Data Collection

Data were collected from patients' hospital records, including demographic data, burn characteristics, burn determinants, and burn outcomes. The extent of burn injury was determined by the total body surface area (TBSA). Outcomes recorded included mortality, hospital admission, and duration of hospital stay, from routine care to advanced care, according to the patient's needs.

Similar data was collected from burn patients between June 10th and June 30th, 2024, which coincides with the period of Arbaeen (August 10th to August 30th, 2024). This period resembled the Arbaeen pilgrimage in terms of duration and environmental circumstances, including weather, to compare the two periods and to determine whether the Arbaeen pilgrims affect burn incidents.

Ethical approval

Ethical consent for this study was secured from the Karbala Health Directorate, Training and Human Development Center, and Imam AI-Hussein Medical City Hospital issued institutional approval, which was numbered 209 on 29 April, 2024. The research team attended the emergency department and burn unit at the hospital to clarify the study's purpose and obtained verbal consent from the administrators, who agreed to collaborate with the researchers.

Statistical analysis

After data collection, they have been coded and analyzed by the application of statistical procedures and by using the Statistical Package for Social Sciences (IBM SPSS) program (version 26). Minitab program version 21 for Windows was used to analyze and assess the results of the study, which included the chi-square test (X2), and a descriptive statistical data analysis approach was used for determining the statistical tables, percentages, pie chart, and bar charts. A t-test was used to compare means between groups. The Mann-Whitney test was used to compare between non-parametric variables. Statistical significance was considered whenever the p-value was equal to or less than 0.05.

Results

The study included 67 cases of burn injuries during the Arbaeen period and 97 from a comparable period. The incidence of burns during Arbaeen was 0.31%, compared to 0.75% outside of Arbaeen, among all admitted cases to the emergency department (21,361 patients against 12,837 patients). After comparing the Arbaeen pilgrimage to other times, it was found that the Arbaeen pilgrimage records fewer burn injuries than usual times ($p = 0.019$). Furthermore, there is a significant difference between Karbala citizens and others ($p = 0.009$) (Table 1).

People in the Arbaeen group were between the ages of one year and seventy, and those in out Arbaeen group were between the ages of one year and seventy-five. The majority of Arbaeen participants (43.3%) were between the ages of 18 and 38 years. Among out Arbaeen participants, those less than 18 years old comprise the larger group (38.1%).

The majority of the Arbaeen patients (85.5%) were from Iraq, specifically Karbala province, with the remaining 10.5% from other nationalities. Whereas there is only one foreigner documented during out Arbaeen period. Findings from this research indicate that the most prevalent mechanism of burn injury among both groups is the fire, which accounts for 77.6% against 84.5% in Arbaeen and out of Arbaeen, respectively. Followed by hot liquids and electricity. Table 2 explains the characteristics of burns, such as injury site, burn degree, and TBSA among patients of Arbaeen and out Arbaeen. The most frequent laboratory investigation performed on the patients of both groups was a virology test. Whereas silver sulfadiazine is the most prescribed medication, followed by IV fluids. Table 3 shows the performed laboratory investigations and prescribed medicines for the two groups of burned patients in the ED.

Concerning the duration of hospitalization of the admitted patients, there was no statistically significant difference in the duration of hospital admission between the Arbaeen and non-Arbaeen groups (P = 0.720). The median duration of admission during the Arbaeen period was 2.33 days (IQR: 7; range: 1–30), compared to 2 days (IQR: 5; range: 1–20) in the non-Arbaeen group (Table 4).

Table 1: Demographic features of the participating patients in the two study groups

Variables	Arbaeen period	Out of Arbaeen	p-value
	Frequency (%)	Frequency (%)	
Total Patients	**67 (0.31%)**	**97 (0.75%)**	0.019
Sex			
Male	43 (64.2)	59 (60.8)	0.663
Female	24 (35.8)	38 (39.1)	
Age groups			
<18 years	28 (41.8)	37 (38.1)	0.416
18-38 years	29 (43.3)	35 (36.0)	
39-58 years	8 (11.9)	20 (20.6)	
>59 years	2 (3)	5 (5.1)	
Nationality and Provinces			
Karbala	47 (70.1)	83 (85.6)	0.009
Other Iraqi provinces	13 (19.4)	13 (13.4)	
Foreigners	7 (10.4)	1 (1.0)	

Table 2: Characteristics of burns among patients of Arbaeen and out Arbaeen.

Criteria	Arbaeen period	Out of Arbaeen	p-value
	Frequency (%)	Frequency (%)	
Total patients	**67**	**97**	
Mechanism of burn injury			
Fire	52 (77.6)	82 (84.5)	0.807
Hot liquids	10 (14.9)	11 (11.4)	
Electricity	4 (6.0)	4 (4.1)	
Chemical agent	1 (1.5)	0 (0)	
Injury Site			
Head	18 (26.9)	32 (33)	0.771
Chest	14 (12.9)	20 (20.6)	
Abdomen	11 (16.4)	17 (17.5)	
Back	15 (22.4)	21 (21.6)	
Pelvis	13 (19.4)	12 (12.4)	
Upper extremities	33 (49.3)	54 (55.7)	
Lower extremities	32 (47.9)	42 (43.3)	
Burn Degree			
First degree	35 (52.2)	46 (47.4)	0.788
Second degree	15 (22.4)	22 (22.7)	
Third degree	17 (25.4)	29 (29.9)	
Total Body Surface Area Percent (TBSA %)			
Mild <10%	19 (28.4)	28 (28.9)	0.501
Moderate 10-20%	18 (26.9)	17 (17.5)	
Severe >20%	30 (44.8)	52 (53.6)	

Table 3: Performed laboratory investigations and prescribed medications to the burned patients in the Emergency Department.

Criteria	Arbaeen period	Out of Arbaeen	p-value
	Frequency (%)	Frequency (%)	
Lab. Investigation			
Virology test	30 (44.77)	48 (49.5)	0.602
Complete blood count	35 (52.23)	46 (47.4)	
Random blood sugar	6 (8.95)	7 (7.2)	
Renal function test	10 (14.92)	8 (8.2)	
Medication			
IV Fluid	32 (47.8)	54 (55.7)	0.843
Fucidic acid cream	16 (23.8)	34 (35.1)	
Silver sulfadiazine	54 (80.6)	91 (93.8)	
Analgesia	42 (62.7)	84 (86.9)	

Table 4: Comparison of duration of admission based on during or out of Arbaeen

Duration of Admission						p-value
Arbaeen period			Out of Arbaeen			
Median	Min-Max	IQR	Median	Min-Max	IQR	0.720
2.33	1-30	7	2	1-20	5	

IQR: Intraquartile range

Regarding patient outcomes, 52.2% of individuals in the Arbaeen group received medical treatment and showed clinical improvement upon discharge from the Emergency Department, compared to 35.1% in the non-Arbaeen group. Additionally, a notable proportion of patients in the non-Arbaeen group (39.2%) were discharged against medical advice (i.e., discharged by their own responsibility) in contrast to only 14.9% in the Arbaeen group (Figure 1).

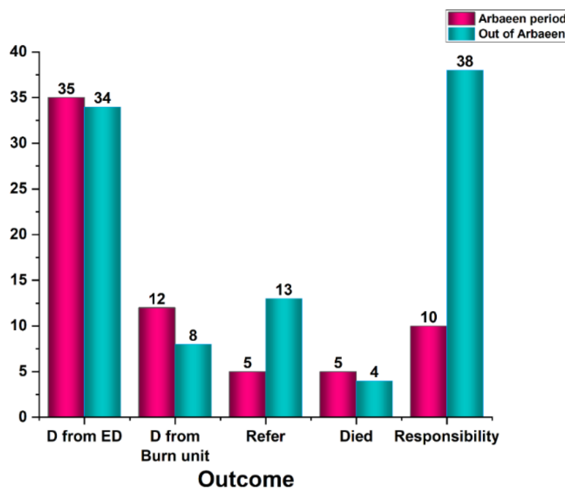

Figure 1: Patient disposition and outcome patterns in Arbaeen and out-Arbaeen groups

D: discharged; ED: Emergency Department

Discussion

The nature of burn injuries often results in a prolonged clinical journey for patients, frequently leading to long-term health effects, social stigma, and financial difficulties for both patients and their families [26]. According to the data collected, the Arbaeen burn injuries represent 0.31% of total ED admissions, while out Arbaeen burns represent 0.75%. These percentages are considered high compared with other studies conducted in Spain, Canada, and Pakistan, where the incidence of burn injuries was 0.036%, 0.12%, and 0.15%, respectively [27, 29]. Whereas the United States reports a higher incidence rate than the Arbaeen group of 0.4% [30]. The incidence of burns during the Arbaeen period is less than it is during other periods outside of Arbaeen. This difference might be due to chance, missed files due to pilgrimage loading, or other specific factors in this timeframe. Increasing awareness during the Arbaeen pilgrimage in terms of group cooking and awareness to reduce burn accidents, i.e., the events surrounding the Arbaeen pilgrimage are well-organized, with effective safety procedures in place, which could lead to a reduction in the burn rate. Access to Imam AI-Hussein Medical City Hospital is particularly challenging for pilgrims and residents who live in crowded areas such as the area of the governorate. As a result, individuals with minor burn injuries often seek care at nearby hospitals, primary healthcare centers, or the temporary clinics opened during Arbaeen. Others opt for initial conservative treatment followed by direct transfer to their home governorates, since this process is easier than reaching the hospital. Furthermore, suicide cases during the Arbaeen period were not recorded at all, while nine suicide attempts by burning were reported in the out-of-Arbaeen group and in many other studies conducted in several Iraqi provinces [4, 31].

The findings from this research indicate that the vast majority of burn patients are young adults and children. This finding aligns with previous local and international studies [4, 16-17, 32]. The high incidence of burns among young adults may be attributed to risk-taking behaviors, a lack of safety awareness, inexperienced cooking, or increased exposure to hazardous activities. Children are also at significant risk of burns from hot liquids and accidental contact with flames or heated surfaces.

Males in both groups outnumbered females, and it is more obvious in the Arbaeen group. The higher incidence of burn accidents among men, in contrast to women, can be attributed to several social, cultural, and practical variables associated with this important religious event. Potential factors include the preparation of services for visitors, which plays a predominant role in serving Arbaeen visitors; lack of attention to safety protocols, prolonged working hours and fatigue, utilization of hazardous materials, presence in crowded areas, and electrical accidents. This finding is in line with the American Burn Association's findings, which revealed that the gender percentage of males is 66% and that of females is 34% [33]. Furthermore, the results of this study agree with another study conducted at Baghdad Medical City Teaching Hospital [16]. However, our findings differ from those of Nisavic *et al.* (2017) [34] and the other study conducted in Babylon [4], both of which observed a female

predominance among hospitalized burn patients. This inconsistency may stem from differences in sample size. The higher incidence of self-immolation in their populations may be another contributing factor. Given that women are at greater vulnerability to suicidal burn attempts, as documented in a systematic review [31] that includes data from 13 Iraqi provinces that revealed that women were at greatest risk. Other studies state that a female-to-male ratio of nearly 4:1 [35]. It is important to note that during the research period, no suicide attempts were reported in the Arbaeen group, whereas nine cases were reported in out Arbaeen group. The number of burn patients from other governorates and nationalities throughout the Arbaeen days exceeded the number of burn patients recorded at other times with the same demographic (29.8% against 14.4%).

Results obtained showed that the majority of burn injuries are caused by fire. Flame burns were overwhelmingly the most common type of burn injuries, as observed in other studies [7, 36]. This suggests that exposure to open flames from cooking fires or accidental contact with burning materials poses a significant hazard during these mass gatherings. The crowded, often unsupervised environments typical of large-scale pilgrimages may contribute to both the frequency and severity of these injuries. Factors such as inadequate safety measures, limited emergency response, and the cultural importance of fire in public practices play a critical role. This study disagrees with Armstrong and his colleagues' study, which identified hot liquids as the most prevalent cause. The disagreement arises from the finding that the one-to-four age group presented the highest incidence of reported burns due to exposure to hot liquids [32].

The severity of the burn was classified in TBSA, burn degree, and localization of the burns [10]. The results of this study indicate that the majority of burn injuries sustained during the Arbaeen pilgrimage in Karbala were first-degree burns (52.2%). These frequencies were quite similar to those reported in a study in the Baghdad Burn Hospital [16]. In this study, the burns were primarily superficial; a significant portion of patients had severe TBSA involvement. This indicates that while the depth of burns was generally mild, the area of the body affected was large in many cases. Compared to out Arbaeen studies and those from other provinces of Iraq, such as Baghdad and Duhok, where burns are deeper (second- and third-degree) [37-38], our findings suggest a different risk profile during the Arbaeen pilgrimage. The unique environmental and logistical conditions of such burns are often caused by brief exposure to heat sources, such as hot water or controlled flame. They are common in crowded and temporary environments like pilgrimage camps, where there is mass cooking in open areas, temporary heating systems, and high population density, especially when people wear loose clothing in the summer. The season that the study was conducted may contribute to a higher incidence of widespread but less severe burns. Moreover, self-inflicted burns occurring outside the Arbaeen period tend to result in more severe injuries.

Burn distribution is significant in treatment planning and ascertaining the necessary volume for patient recovery. It also helps to assess whether critical care or referral to specialized facilities is needed. In some patients, two or more body parts are involved. The upper and lower extremities are the most affected regions of the body in the Arbaeen burns. This result agrees with Mulatu *et al.* (2022) study that the extremities were the most affected body parts [39]. Due to the close position of the head and face to the eyes, auditory organs, and airways, burns in these areas are particularly hazardous. The study indicated that burns affecting the head constituted 26.9% of cases that included the face and neck, in comparison with out Arbaeen group, where the head injury constituted 33%, and with another study, which classified it to the face (24.5%), neck (17.8%), and head (12.4%) [39]. This may be attributed to the characteristics of the offending agent and the individual's reaction to the situation.

Upon arrival at the ED, burn patients undergo prompt evaluation. More than half of the Arbaeen patients experienced simple burn injuries. They receive suitable treatment, including washing, analgesics, and bandaging, and are subsequently discharged with instructions for home wound care. In the ED, effective pain management is crucial, since this study indicated that analgesic administration at the emergency department occurred in 62.7% of cases. Typically, adequate analgesia consists of paracetamol with or without tramadol. Fluid resuscitation in burned patients is an essential aspect of initial burn therapy, especially for those with considerable TBSA involvement. Burns can result in significant fluid changes, capillary leakage, and hypovolemic shock if inadequately controlled [40]. Anti-tetanus serum (ATS) is an important prophylactic agent in burn management; however, its availability is often

inconsistent. Prophylactic systemic antibiotics are generally not recommended initially in the ED, but topical agents are used for local infection prevention. Wound dressings, with silver sulfadiazine 80.6% and fucidic acid 23.8%, were achieved in this study. Conversely, certain situations necessitate more intricate treatment, such as extensive burns or those affecting a substantial portion of the body. These patients, constituting 32.9% of the total, were admitted to a burn unit during Arbaeen. Although burn injury severity was higher during the non-Arbaeen period, only 23.7% of patients were admitted during the non-Arbaeen period. This relatively low admission rate may be explained by the large number of patients who were either referred to other hospitals or discharged against medical advice, as open roads and unrestricted movement provided more options for seeking alternative care. Burns' journeys vary from person to person. Still, they always require patience, whether they are short and end with a quick exit or long and require intensive treatment and natural rehabilitation for life.

The current study reported a mortality rate of 7.5% in the Arbaeen group and 4.1% in out Arbaeen group, while an Indian study reported a fatality rate of 31.58% over one year [24]. In the Al-Diwaniyah and Babylon province studies, the mortality rate reached 13.6% and 27%, respectively [4, 41]. Variations in study outcomes may be attributable to methodology (institutional settings, sample size, duration of study period, etc.). Divergences in patient demographics and health variables may correlate with these disparities, as well as the variance of therapeutic approaches and medical methodologies employed. Furthermore, the intentionally self-inflicted burn injuries carried a higher mortality rate.

The similarity in duration of admission between the Arbaeen and non-Arbaeen groups, despite differences in patient numbers and injury patterns, suggests that the duration of hospitalization was not influenced by the timing of the mass gathering. The lack of statistical significance may reflect consistent treatment protocols and discharge criteria regardless of the context. Additionally, the slightly broader interquartile range during Arbaeen may indicate greater variability in clinical severity or resource availability during this period. In comparison with Akkoç and Bülbüloğlu (2022), who determined that the length of stay in the burn ward was 9.26 ± 7.83 (0-46) days [42].

Study limitations

The main restriction identified was the inadequate recordkeeping across all sites of care, resulting in insufficient information and the exclusion of a number of patients. Data heterogeneity, such as differences in burn classification, treatment methods, or diagnostic criteria between hospitals or countries.

Conclusions

The incidence of burn injuries during the Arbaeen pilgrimage was lower than anticipated. Children and adolescents are particularly susceptible to burns. A review of the emergency cards and burn ward documentation revealed that no instances of suicide were recorded throughout the Arbaeen pilgrimage period.

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